

First record of *Volvariella cubensis* (Murrill) Shaffer (Agaricales, Basidiomycota) from Mexico

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Abstract

Volvariella cubensis (Murrill) Shaffer is distinguished by the dark-gray and fibrillose pileus, pinkish free gills and the thick, brownish volva. This species is described and illustrated from the state of Tamaulipas in northeastern Mexico and constitutes the first record for the country, as well as the northernmost occurrence of *V. cubensis* in America. Descriptions, photographs, and discussion are presented.

Keywords

Diversity, Funga, macrofungi, Pluteaceae, Tamaulipas.

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Introduction

The genus *Volvariella* Speg. within the family Pluteaceae Kotl. & Pouzar (Agaricales, Basidiomycota) was described by Spegazzini in 1899. Most of its species grow on humus and dead wood in grasslands or in forests, but mycoparasitic taxa are also known (Justo et al. 2011). It is a widely distributed genus with reported species from tropical, subtropical, and temperate regions of the Eastern and Western hemispheres (Shaffer 1957).

The species of *Volvariella* are characterized by their pink free gills, pink spore print, the presence of a sac-shaped volva at the base of the stipe, basidiospores reaching up to 11 µm, the bilateral trama, and a trichodermium with hyphae wider than 15 µm (Singer 1986). This genus differs from related genera within Pluteaceae, such as *Volvopluteus* Vizzini, Contu & Justo in its spore size and pileipellis arrangement and *Pluteus* Fr. by the presence of the volva (Pegler 1983; Campi et al. 2019). *Volvariella*

comprises around 50 species worldwide (Kirk et al. 2008; Niveiro et al. 2017), and 15 species have been reported in Mexico (Guzmán and García-Saucedo 1973; Manzi 1976; Guzmán 1977; Valenzuela et al. 1981; Guzmán-Dávalos et al. 1983; Mora and Guzmán 1983; Mora 1985; Guzmán et al. 1986; Bandala et al. 1988; Téllez et al. 1988; Vázquez and Guzmán-Dávalos 1988; Vázquez et al. 1989; Vázquez y Guzmán-Dávalos 1991; Guzmán 2003; Perez-Silva et al. 2006; Gándara et al. 2014).

Volvariella cubensis (Murrill) Shaffer is characterized by the dark-gray and dark, fibrillose pileus, the thick volva, and the size and shape of the basidiospores. *Volvariella cubensis* is a Neotropical species originally described from Cuba (Murrill 1911) and is known from Guadalupe in the Antilles (Pegler 1983), southern India (Farook et al. 2013) and Brazil (Wartchow 2009). In recent mycological explorations in the Mexican state of Tamaulipas, several basidiomata of *V. cubensis* were

collected representing these first records of this species in Mexico, as well as the northernmost occurrence of the American continent.

Methods

Mycological explorations were conducted in the Mexican state of Tamaulipas (Fig. 1). The vegetation dominating in the sampling sites was a tropical forest with *Casimiroa pringlei* (S. Watson) Engl., *Ebenopsis ebano* (Berland.) Barneby & J. W. Grimes, *Havardia pallens* (Benth.) Britton & Rose, *Ocotea tampicensis* (Meisn.)

Hemsl., *Platanus rzedowskii* Nixon & Poole, *Randia obcordata* S. Watson, *Sabal mexicana* Mart., *Sideroxylon lanuginosum* Michx., *Sideroxylon persimile* (Hemsl.) T. D. Penn., *Ungnadia speciosa* Endl., and *Zanthoxylum fagara* (L.) Sarg. (García-Morales et al. 2014). The sampling methods proposed by Lodge et al. (2004) were followed. The color was described according to Kornerup and Wanscher (1981). Hand-made cuts from some sections were used to prepare preparations using solutions such as 5% KOH (Potassium hydroxide) and Melzer reagent for microscopic analysis. The size of the micro-characters such as basidia, cystidia, and basidiospores

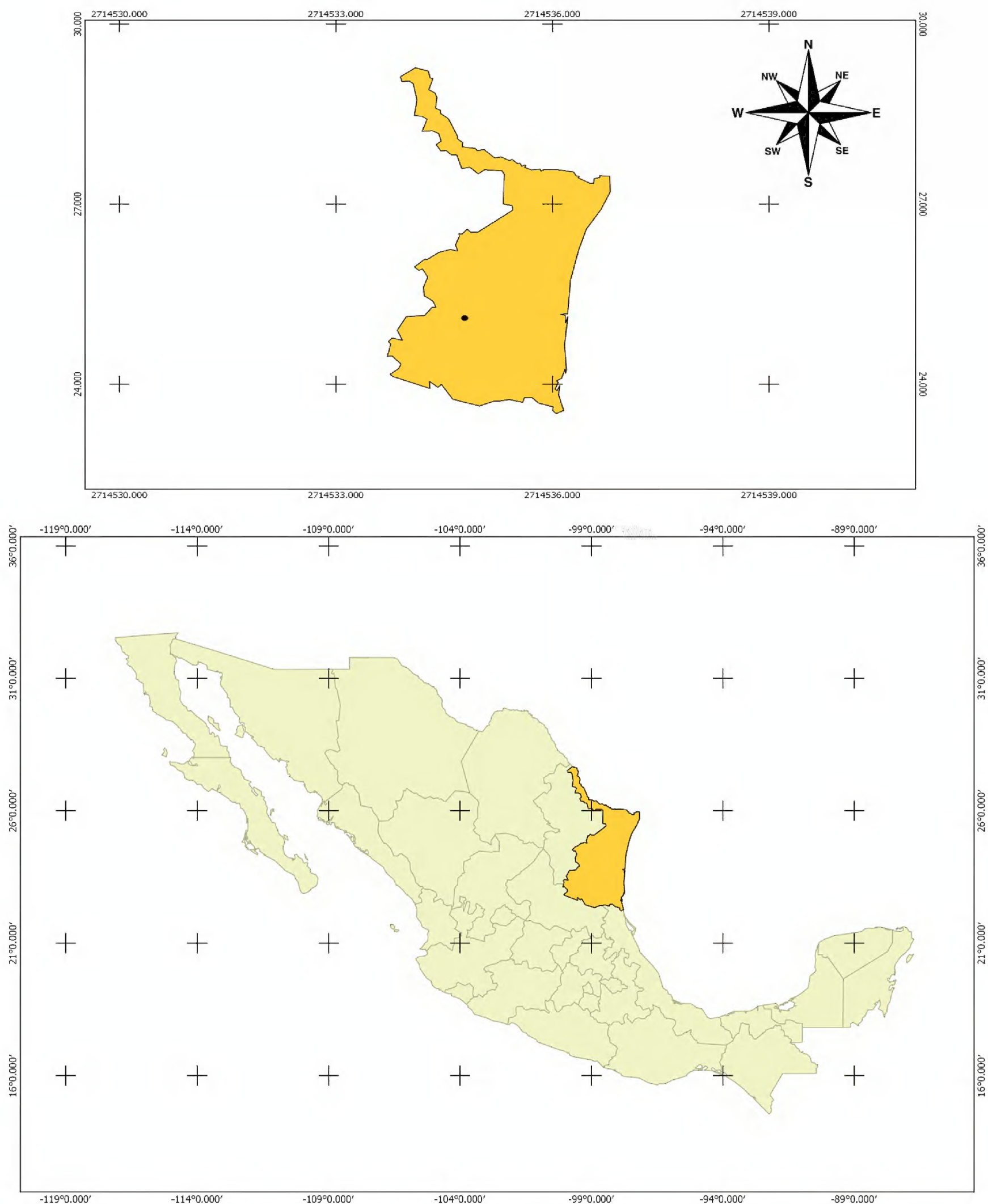


Figure 1. Current distribution of *Volvariella cubensis* in Mexico.



Figure 2. *Volvariella cubensis*. (García-ITCV-21270). Scale bar = 20 mm.

were determined by measuring at least 20 elements each. Abbreviations used are: Q = length/width ratio of the basidiospores; L = average length; W = average width; N = total of spores measured. For the identification of the species, specialized literature was consulted (Murrill 1911; Shaffer 1957; Pegler 1983, 1988; Wartchow 2009). All the specimens were herborized and deposited in the “José Castillo Tovar” mycological herbarium at the Instituto Tecnológico de Ciudad Victoria (ITCV).

Results

***Volvariella cubensis* (Murrill) Shaffer, Mycologia 49: 564. 1957.** Figures 2, 3

New records. Mexico: Tamaulipas, Cañón del Novillo–Las piedrotas, km 6 road to La Mina, 23°42'35"N, 099°13'43"W, Jesús García, 28 October 2015 (García-ITCV-20777). km 8 road to La Mina, 23°42'55"N, 099°14'24"W, Jesús García, 2 November 2016 (García-ITCV-21268). Same place, Jesús García, 4 November 2016 (García-ITCV-21270).

Identification. Pileus 33–116 mm in diameter, convex, umbonate or flattened, radially covered by olive-grey (7F3–8F2, 6F3–F4), silky fibrills, darkening at the center, sometimes cracking when mature. Lamellae free, cream to pinkish (7A2–A3, EA2–A3), crowded, margin

free, smooth, reaching 10 mm wide, with short lamellulae near the pileus margin. Context white, 6–8 mm thick, slightly bruising gray near the lamellae when cut. Stipe 70–118 × 05–11 mm, whitish, fibrillose, with a slightly bulbous base, covered by a fleshy, brownish, pale-brown to greyish sac-like volva. Volva fleshy, brown, 18–20 × 16–18 mm. Odor fungoid, taste not recorded. Chemical reactions: KOH negative in all tissues.

Basidiospores 5.5–7.5 × 4.5–6 μm (Q = 1.22, L = 6.41 μm, W = 5.23 μm, N = 40), broadly ellipsoid, hyaline to light green in KOH, yellowish in Meltzer, sometimes with a conspicuous hilar appendage, thick-walled, smooth. Basidia 27–38.5 × 7.5–9.5 μm, clavate, yellowish, four-spored, thin-walled. Pleurocystidia 61.5–98 × 15–23.5 μm, lageniform, hyaline, thin-walled. Cheilocystidia 73–83 × 31–33 μm, ventricose to fusoid, hyaline, thin-walled. Hymenophoral trama bilateral, composed of filamentous hyphae, 5.5–8 μm, hyaline in KOH, thin-walled. Pileipellis a trichodermium composed of cylindrical hyphae, with terminal cells, ventricose to rostrate, 47–90 × 6–12 μm, hyaline, thin-walled. Surface of the volva with thin hyphae, 47–90 μm, attenuated at the apex, somewhat obtuse, hyaline to yellowish, thin-walled. Clamp connections absent in all tissues.

Habitat. Scattered on humus in tropical forest, under *Ebenopsis ebano*, *Casimiroa pringlei*, and *Sideroxylon persimile*.

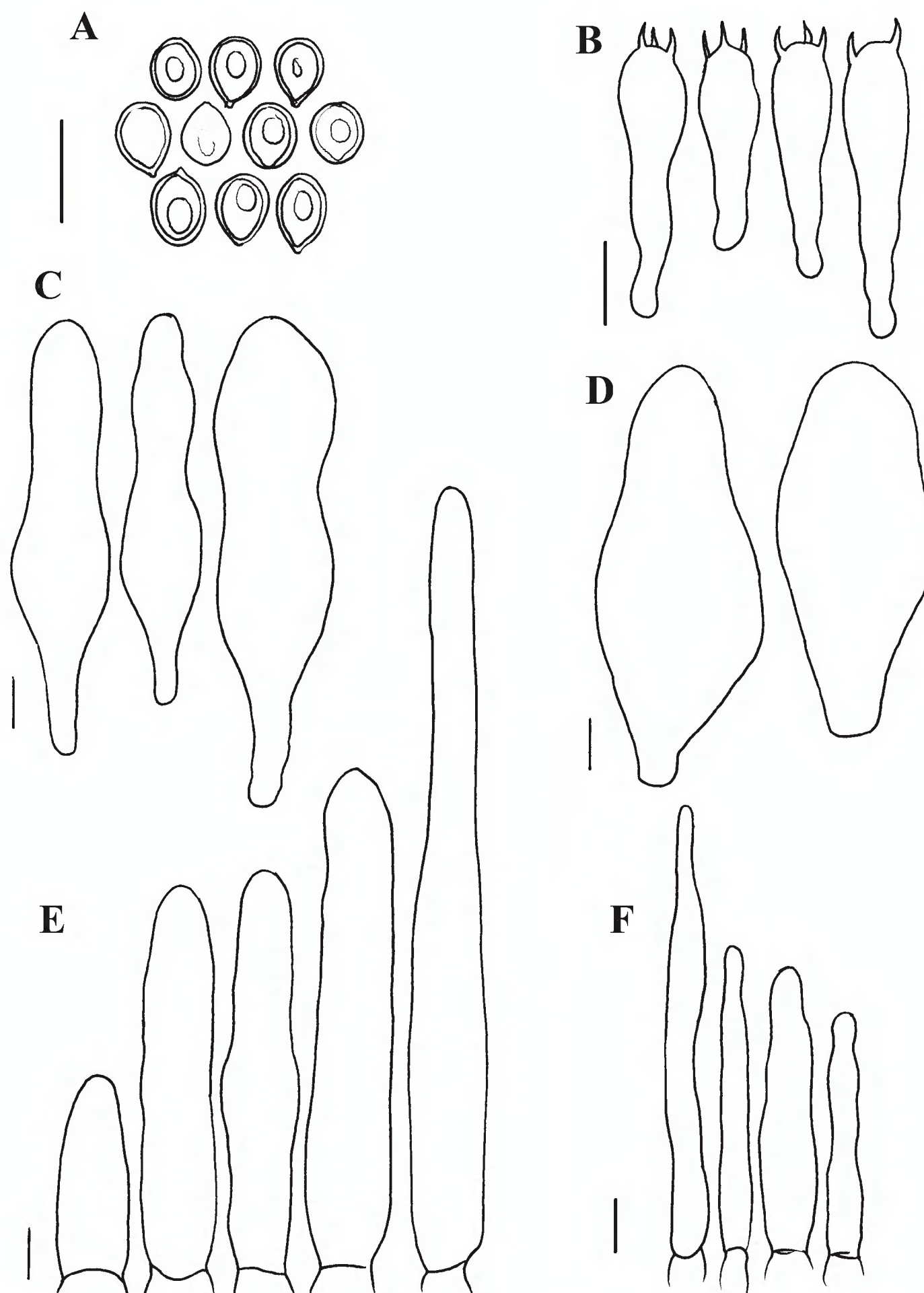


Figure 3. *Volvariella cubensis*. (García-ITCV-21270). Microscopic features. **A.** Basidiospores. **B.** Basidia. **C.** Pleurocystidia. **D.** Caulocystidia. **E.** Elements of pileipellis. **F.** Elements of the volva. Scale bars = 10 µm.

Discussion

Volvariella cubensis is a species originally described from Cuba (Murrill 1911) as *Volvariopsis cubensis* Murrill. This species is characterized by its gray, fibrillose pileus, fleshy and persistent volva, and spore size. This species is distributed in Cuba, the Antilles, Brazil, Mexico, and India. The morphological characters of the Mexican material agree well with those mentioned by Shaffer (1957), Pegler (1983), and Wartchow (2009). The specimens studied here grows from solitary to gregarious in small groups on the ground, in the tropical forest at 350 m.a.s.l., coinciding in its habit with the specimens studied by Murrill (1911), Pegler (1983), and Shaffer (1957) but differing with the specimen studied by Wartchow (2009) which was found growing on wood.

This species differs from other tropical *Volvariella* species, such as *V. taylori* (Berk. & Broome) Singer, *V. pseudovolvacea* (Berk. & Broome) Singer, and *V. pusilla* (Pers.) Singer, by the fleshy and large basidioma (Pegler 1983). *Volvariella bakeri* (Murrill) Shaffer is a similar species but it differs by the slender basidioma, smaller pileus, smaller ellipsoid spores, and different shape for the cystidia (Pegler 1988). *Volvariella volvacea* (Bull.) Singer is another similar species that is differentiated by its significantly larger spores and its cheilocystidia often more than 50 µm long (Shaffer 1957).

According to Guzmán (2003), all species of the genus *Volvariella* are edible. Although some species, such as *V. bomicina* (Schaeff.) Singer and *V. volvacea*, are recognized as edible fungi of good quality, there are no

available data about the edibility of *V. cubensis*. More studies should be done on the edibility of this remarkable species.

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Authors' Contributions

JFHD, JD and JGJ collected the specimens. JGJ identified the collections and wrote the description. JIF and JFHD wrote the text and made the illustrations. All the authors revised the manuscript.

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